# ONE EXPLANATION OF REPORTED SHOWERS OF TOADS.

BY DR. CHARLES CONRAD ABBOTT.

(*Read April 8, 1904.*)

The frequent references in newspapers to occurrences of "showers of toads" have suggested to the author that a condition in the life-history of the spade-foot toad, a little-known and strictly nocturnal species, living in the ground, might explain them more rationally than that the little batrachians are picked up by the wind in one place and dropped in another, perhaps miles away, or that other still more strange view quite common among the ignorant that toad-spawn is sucked up by the sun and hatched in clouds, where the tadpoles remain until they have advanced to the dignity of hoppers, when they fall to the earth. Unlike the common toad and the frogs, the spade-foot toad (*Scaphiopus solitarius*) does not have a regular season for deposition of ova, but the eggs may be laid at any time from April 1 to August 31. Furthermore, this batrachian does not resort to permanent watercourses or ponds on such errand, but takes advantage of temporary pools formed by showers of longer duration than is usual. It is remarkable how admirably this strange irregularity of an important event should be adapted to transitory conditions. Pools of rainwater seldom remain long on the ground's surface. Soakage and evaporation soon obliterate them; but that this may not prove a fatal objection, the eggs of the spade-foot toad hatch in about ninety-six hours, and in less than two weeks, or fourteen days at most, the tadpole has become a terrestrial animal or a "hopper" and leaves its nursery. The development is even more rapid occasionally, I am led to believe, being accelerated by excessive warmth or retarded if the days are cool and cloudy.

It will be readily seen that young spade-foot toads, congregated in or immediately about a temporary pool, will not wander far from it when their subterranean life begins, but will bury themselves in the comparatively moist ground where they happen to be. Should, at this time of their limited wandering, there occur one or more violent showers, the ground being wetted and little pools formed, the young spade-foot toads would necessarily, we might say, wander over a much wider extent of territory, and, escaping notice when confined to one fast disappearing pool, would be observed when dotting the ground over an extent perhaps of an acre or more. Seen thus, immediately after rain, and not previously noticed, the inference is not so strange that they came to the earth with the rain, or that there had been a shower of toads as well as of water.

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# EXPANSIONS OF ALGEBRAIC FUNCTIONS AT SINGULAR POINTS.

BY PRESTON A. LAMBERT.

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## I. Introduction.

An algebraic equation $F(x, y) = 0$ of degree $n$ in $y$ defines $y$ as an $n$-valued algebraic function of $x$. When these $n$ values of $y$ are all distinct for a given value of $x$, that value of $x$ is called a regular point of the algebraic function, and the $n$ branches of the function are extended by applying the law of the continuity of each branch.

In curve tracing $x$ and $y$ are real variables and only the real branches of the function are used. Real values of $x$ and $y$ which satisfy the equations $F(x, y) = 0$, $\frac{\delta F}{\delta x} = 0$, $\frac{\delta F}{\delta y} = 0$ determine multiple points of the curve which represents the equation $F(x, y) = 0$. If $x = a$, $y = b$ is a multiple point of this curve, the behavior of the curve at the multiple point is determined from the expansions of $y - b$ in terms of $x - a$. Inasmuch as the transformations

$$x = x_1 + a, y = y_1 + b$$

transfer the origin to the multiple point, the multiple point will always be taken at the origin.

An algebraic equation between complex variables $F(w, z) = 0$ of degree $n$ in $w$ defines $w$ as an $n$-valued algebraic function of $z$. Values of $w$ and $z$ which satisfy the equations $F(w, z) = 0$ and $\frac{\delta}{\delta w} F(w, z) = 0$, determine branch points of the algebraic function, that is points where several branches of the function meet. The behavior of the function at a branch point is determined from the expansions of the function at the branch point.